No. VIII.

MACHINERY FOR CUTTING THE STAVES OF CASKS.

Observations on the Machinery for cutting the Staves of Casks. By J. ROBISON, Esq. of Edinburgh, and Mr. GEORGE SMART, of Pedlar's Acre, Lambeth.

IN November 1828, Mr. Robison addressed to the Society a notice respecting a method of cutting the staves of casks, which had been practised at Glasgow, accompanied by a plan of his own for effecting the same purpose by simpler apparatus. While this communication was under discussion in the Committee of Mechanics, to which it had been referred, Mr. Smart, one of the members of the Society, stated, that many years ago he had invented and used for some time, on a large scale, an apparatus for cutting the staves of casks. At the request of the Committee he furnished a detailed description of his method, which, in some particulars, was found to agree with Mr. Robison's proposal, but to differ from it in some others; the difference being partly in principle and partly in those circumstances which constitute the distinction between an invention in speculation and the same when reduced to practice.

An extract from Mr. Robison's letter is subjoined, sufficient to establish his claim to the credit of being an original inventor, but omitting the diagrams with their description; as the methods there proposed, besides being

deficient in detail, are not equal in adaptation to those which had been long before practised by Mr. Smart, although they have not hitherto been given to the public.

Extract from Mr. Robison's Letter.

9, *Athole Crescent, Edinburgh, Nov.* 20, 1828.

Some years ago a patent was taken out for making casks by machinery. The apparatus consisted principally of circular saws placed in frame-work, by means of which thin planks of proper lengths were conducted against the edges of the saws, in such directions as to cause the cuts to be made in the proper curve for giving the desired form to the casks, on a certain number of staves being bound together in the usual way. In order to effect this, many complex movements and adjustments in the frames were necessary; and as the saws had to work through curved slits, great friction was excited, and much power required to overcome it.

An extensive establishment was formed under this patent at Port Dundas, near Glasgow, in which the whole of the machinery was got up in the best style of workmanship, and a thirty-horse engine employed to set it in action. The casks made in this establishment were principally of small dimensions, such as herring barrels, and the staves made use of were of soft woods; yet difficulties were found to occur in practice which rendered the concern unprofitable, and the undertaking was, after a time, given up.

A little consideration of the necessary form of the staves of a cask will shew that the purpose of the patent machinery may be attained with greater accuracy by

simpler means. It is no doubt true, that if a stave be formed out of a *flat* plank, the edges must have a certain curvature, according to the shape intended to be given to the cask; but if, previously to cutting out the stave, the plank be bent into the shape which it must take when in the cask, then the cut of the saw will be in a plane.

To understand this, let us suppose that a cask, instead of being hollow and made up of thin staves, is built up solid: the staves would, in this case, be a set of wedges, with their apices meeting in the axis of the cask, the heads of the wedges being the curved outer surfaces of the staves; but their sides would be planes, capable of being formed by straight cuts of a saw. If we now suppose the thin portion of each wedge to be hewn away, leaving only what would form the stave of a hollow cask, the remaining position of the side of the wedge, which would then form the border or edge of the stave, would continue to be in a plane.

This being understood, it appears that if the planks for staves be bent into the proper form *previous* to their being sawn, instead of *after*, there would be no difficulty in giving them any requisite shape by a common circular saw.

Many ways of applying this principle will suggest themselves to every intelligent mechanist; and it is, therefore, with great deference that I suggest the following construction as an illustration of my meaning.

JOHN ROBISON.

Mr. Smart's Letter.

SIR, *Pedlar's Acre, February 5*, 1829.

The following are the methods invented and brought

into practice by me for preparing staves and making casks by machinery:—

At the time of Admiral Christian's expedition to the West Indies, I received orders to furnish about 30,000 small casks; but the time allowed for this was so short as to render it wholly impossible to make them by the common method of coopering. I therefore, on this occasion, for the first time, determined to cut out the staves by the circular saw, and, at the same time, combined the use of this instrument with other articles of apparatus hereafter described.

Staves made by hand are never accurately equal in width, and therefore, when all the staves but the last have been placed side by side within the truss hoops, much time is always lost in looking for a stave of the exact size wanted. This main source of delay I avoided in the following manner: — The length and thickness of the staves required for casks of a given size having been determined, I then find the circumference or girth of the intended cask at the ends and at the greatest bulge, and dividing these quantities by the number of the staves, the quotient gives me accurately the greatest and least width of each stave. The whole parcel of staves required for the casks is then correctly cut according to the calculated dimensions; and thus the staves are put together within the hoops just as they happen to come to hand, without any necessity for selection.

The intended swell or bulge is thus given. In small light casks, where the stave can be bent by hand, I contrived a block, having the upper surface curved so as exactly to equal the intended swell of the cask, and the sides bevelled to correspond with the necessary bevel of the staves. See Plate VIII. figs. 1, 2, 3. *a a* are two studs

which slide parallel to the saw *k* in a groove *b* of the saw-bench; *c c* is the stave, secured at one end by being thrust under the hook *d*, and at the other end held down either by the hand or by a hook similar to *d*, according to the size and stiffness of the stave.

But this method of giving the perfect figure to the stave, though so direct and simple, would require, in cutting those for large casks, either a saw unusually large or a bench curved as fig. 4, to enable a common-sized saw to reach the stave at its bulge. Neither of these methods, however, is good, it being always desirable to use the smallest saw that will conveniently pass through the stuff, and so mounted as to be applicable to general purposes; that is, for any kind of work.

I therefore used another method. Instead of making the studs *a a* traverse in straight grooves, I fixed on a guide-plate *ee*, figs. 5 and 6, having two exactly similar grooves *f*, lined with iron and curved so as to suit the swell of the cask; in these the studs *f f* of the straight block *g* travel: *c* is the stave secured on it by hooks at each end. The consequence of this arrangement is, that the block recedes from the saw while one half of the stave is passing, and then returns while the other half of the stave passes. It might be thought, that as the stave passes thus somewhat obliquely, the saw in this position would not cut well: the curve, however, being very small, and the stave passing only over the top of the saw, no practical inconvenience is experienced, the deviation not being more than the saw will readily admit. The block *g* is bevelled to suit the radius of the cask, as shewn in the end view, fig. 7. When the staves have been bent, these bevels will be found to be a little winding; that is,

if they fit at the bulge, the inner corners will meet first at the ends; but this error is too minute to be of any importance. When the second side of the stave is to be cut, some kind of stop, as the pins *ll*, fig. 2, should be used, against which the stave may press in order that it may be of the exact width: these stops are held up by weak springs, in order to allow the stave to lie over the stops, by depressing the springs while the first side is cutting.

As the goodness of a cask depends much on the manner in which the heads are prepared and put in, I invented two very simple but useful tools for this purpose. The cask, while in the truss-hoops, is placed on a horizontal lathe, and the chime and groove are both of them turned: for the groove, the cutter *h*, fig. 8, is used, being fixed in a strong handle, the length of the tool and handle being two feet at least. The head of the cask is also turned in a lathe to the diameter required, and then the tool *i*, figs. 9, 10, 11, is applied to the edge, in order to make it fit the groove exactly, which, if done properly, does away with the necessity of rushes as stuffing. This tool is made of iron, lined on the inside with steel: it is about two feet long, and is bent up like a trough, the two sides being inclined to each other at an angle varying from 45° to 60°. Fig. 9 is an end view; fig. 10 a side view; and fig. 11 a back view. When in use, the angle is uppermost, so that the tool is quite steady on the rest; and the angle is previously ground so that the notch exactly fits the cutter *h*, fig. 8.

The belly of the stave is cut out to facilitate the bending, instead of sawing or chopping it out. For this purpose I used a block, fig. 12, of a proper curvature,

bent back the stave upon it, and confined it by two hoops and wedges while it was cutting: every stave was thus cut alike, and the barrels made of equal capacity.

There were, at that time, in the market, many rough American staves, which it cost much labour and time to trim by hand. I therefore contrived the tool, figs. 13, 14, 15, to hold them during that operation. It is a sort of clamp, the length of which may be varied by moving the block *m* and the screw *n*, which holds it to any of the holes *o o*. This screw passes through the two plates *p p*, one at each side of the block, as shewn in section, fig. 15. A considerable loss of time would be incurred by running the screw in and out in order to suit the variable length of the stave, I therefore used a rack *q* and a pinion *r*, with a lever handle *s*: this runs quickly up to the work, and the necessary power is given by the lever. In order to retain it at any part that the length of the stave may require, a tumbling catch *t* is jointed to the lever, and falls into the fixed circular rack *v*. There are two handles *u u*, one at each end, by which the tool is lifted up and brought within the action of the saw *k*. At *w w* are iron teeth on the face of the block *m* and the rack *q*, to keep the work steady.

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